ent in the arctic regions from that which prevails in more moderate latitudes; but it serves fully to prove the impossibility of forming any hypothesis respecting the constitution of the atmosphere which shall be universally correct.

Following the above Dr. Young gives some notes as to the effect of a change of a degree Fahrenheit on the astronomical refraction.

Shortly after this time, viz, in the Edinburgh Journal of Science, 1827, Vol. VI, page 246, Sir Thomas Brisbane quotes Fisher's experiments and Dr. Young's remarks in connection with observations made at Port Macquarie, Van Diemens Land, in June, 1824, at an upper and lower station, for the purpose of determining the decrease of temperature with altitude.

In the Edinburgh Journal for January, 1827, Vol. VI, p. 146, Brewster, as editor, commenting on the hourly observations proposed by the Royal Society of Edinburgh, used the following words:

To those meteorologists who have sufficient leisure and the means of performing such experiments, we would recommend the use of kites or of balloons for ascertaining the temperature and state of the upper atmosphere. The Earl of Minto has obtained several very interesting results by the use of balloons.

The observations by the Earl of Minto here referred to were given in the subsequent volume, page 249, where it appears that small captive balloons were used up to a height of 1,340 feet. An observer ascended with the balloon; the height was varied frequently by letting out or pulling in the line. The rise of temperature after sunset at the upper station was well established.

Another account of the experiment by Rev. George Fisher is given at page 187 of the volume of scientific memoirs published at London, 1825, as the Appendix to Captain Parry's Journal of the Second Voyage for the Discovery of the Northwest Passage. In the Appendix No. 2, on Atmospheric Refraction, on page 187, Mr. Fisher says:

It appears by an experiment that when the sea is covered with ice in the winter there is no sensible difference between the temperatures of the atmosphere at the surface of the ice and at the height of 400 feet above it. This was tried by means of a paper kite with an excellent register thermometer attached to it, the altitude of which was determined by two different observers at the time, at a given distance from each other and in the same vertical plane as the kite, and from which the perpendicular height of the kite above the level of the ice was computed. This experiment was tried under favorable circumstances at a temperature of —24° F. The kite was sent up and caught in coming down without the thermometer being in the least disturbed, the indices of which did not show the slightest alteration although carefully compared before and after these experiments and the kite remained at the same height in the air for a considerable time.

There is nothing to show the special date on which this experiment was made, but it may be safely assumed to have been in February or March, 1823. Whether the upper temperature was lower or higher than that near the earth's surface would have been shown by Mr. Fisher's thermometer, since it appears to have been a self-registering Six thermometer in an iron case, whose two indices would respectively show the maximum and the minimum that occurred during each experiment. Of course the iron case or inclosure which protected this thermometer from accident also greatly increased its sluggishness from a thermometric point of view, and as the thermometer remained at its highest altitude only five or ten minutes, it could not be expected to settle a question of a difference of less than 5° F.

The preceding investigations seem to the Editor to have all been suggested by the active discussion that was in those days going on as to the formula for refraction in the atmosphere, in which Dr. Thomas Young and Mr. Ivory took a prominent part.

ARCHIBALD ON KITES.

A little book has just been published in London, entitled The Story of the Earth's Atmosphere, by Douglas Archibald. This volume contains a very readable, popular account of the general composition, temperature, and circulation of the atmosphere, written by one who has himself contributed something to the progress of meteorology. From Chapter XIII we quote the following. After some remarks on balloons and flying machines, Mr. Archibald says:

When a plane surface is forced through the air, the upward pressure of the air is mostly concentrated near its front edge. If the surface extended far back from the edge, its weight would act at some distance from the front edge. Consequently, the unbalanced pressure of the air would tend to turn the plane over backwards. If, however, its width were small, the weight would act so close to where the resistance acts in the opposite direction that the forces would neutralize each other and stability ensue.

Mr. Hargrave has adopted this principle in his cellular or box kite, whose construction is sufficiently obvious to render detailed description unnecessary.

The dimensions are as follows: The length of each cell (from right to left) is 30 inches, and the width and height and opening between are about 11 inches; but these dimensions may vary so long as the two cells together form a nearly square area. An important feature of this peculiar, tailless kite consists of the covered-in sides. These ensure stability even better than two planes bent upward in V shape, such as the wings of the kestrel when hovering, and they prevent the kite from upsetting, very much as the sides of a ship give it stability.

Mr. Maxim once showed the advantage of such side planes by a simple experiment in which a piece of paper, when held horizontally and let fall to the floor, is seen to execute a series of zigzags in the air, frequently ending in its complete overthrow; whereas when the same piece of paper is folded up round the edges like a boat, it sails to the floor quite evenly and in a straight line. * * *

The *kite* was first invented by the Chinese General Han Sin in 206 B. C., for use in war, and was frequently employed after that date in China by the inhabitants of a besieged town to communicate with the outside world. After this kites appear to have degenerated into mere toys.

At the middle of the present century, however, Pocock of Bristol employed them to draw carriages, and is said to have traveled from Bristol to London in a carriage drawn by kites. They were also occasionally employed to measure the temperature of the upper air, by Admiral Back, on the *Terror*, and Mr. Birt, at Kew, in 1847.

These observations had been quite forgotten when the author first suggested the employment of kites for systematic observations in 1883. It has since been discovered that Dr. Wilson, of Glasgow, as long ago as 1749, resuscitated kites from their long burial with a similar idea of employing them to measure temperature.

In the author's experiments, steel wire was first employed to fly them with. Two kites of diamond pattern, made of tussore silk and bamboo frames, were flown tandem, and four self-recording Biram anemometers, weighing 1¼ pounds each, were attached at various points up the wire. Heights from 200 to 1,500 feet were reached by the instruments, and the increase of the average motion of the atmosphere was measured on several occasions for three years. Kites were also employed first, by the author, in 1887, to photograph objects below by means of a camera attached to the kite wire, the shutter being released by explosion. Since that time kite photography has leapt into popularity and has been successfully practised by M. Batut, in France, Capt. Baden Powell, in England, and Eddy, in New Jersey. * * *

It was further suggested by the author, in 1888 (Les Cerfs Volants Militaires. Bibliothèque des Connaissances Militaires. Paris, 1888.), that kites could be used for various purposes in war as well as science.

Since then Capt. Baden Powell, in May, 1895, read a paper on "Kites, their uses in War." In both these publications it was pointed out that kites possessed several distinct advantages over balloons; next, that they could be applied to all the purposes for which balloons could be employed, such as signalling, photography, torpedo projection, carrying despatches between vessels, and, lastly, they could be employed to raise a man for purposes of reconnaissance.

EFFICIENCY OF WINDMILLS.

In his Story of the Earth's Atmosphere, Mr. Douglas Archibald, says:

It is estimated that there are more than a million windmills in the United States alone. The useful efficiency of windmills, especially in the modern geared form, is comparable with that of the best simple steam engines.

A geared modern wheel, 20 feet in diameter, will develop 5-horse power in an 18 mile an hour breeze, and can be applied to work agricultural machinery and dynamos for electric lighting. With a single wheel of this size Mr. McQeesten, of Marblehead Neck, Mass., U. S.